IMPROVED DATA ANALYSIS METHODS AND IMPACT STUDIES FOR SATELLITE SURFACE WINDS IN THE LABRADOR SEA

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LONG TERM GOAL

The goal of this project is to improve surface wind analyses over the high latitude oceans.

OBJECTIVES

The specific objectives are to: (1) develop improved methodologies for the utilization of satellite data in four-dimensional data assimilation and in forecasting, (2) conduct data assimilation experiments in support of the Labrador Sea Experiment, and (3) conduct Observing System Simulation Experiments (OSSE's) to evaluate the potential for advanced passive microwave radiometer to improve ocean surface wind analysis.

APPROACH

The approach is to develop a high resolution variational analysis capable of assimilating different types of satellite surface wind data; produce analyses for the Labrador Sea with and without the satellite data, and then evaluate the data impact.

ACCOMPLISHMENTS

(1) a prototype variational analysis method (VAM) for the assimilation of NSCAT, ERS-2, and SSM/I wind data over the Labrador Sea at .5 degree resolution was developed,
(2) methodology to assimilate SSM/I line of sight winds was developed and incorporated into the VAM,
(3) research to apply SSM/I and NSCAT data to the analysis of cyclones, anticyclones, and fronts was conducted,
(4) ETA model fields over the Labrador Sea for the Intensive Observing Periods were acquired and archived, and
(5) VAM surface analyses using the ETA winds as a background field and incorporating NSCAT data were generated.

SCIENTIFIC/TECHNICAL ASPECTS

The advanced variational analysis was shown to produce highly accurate analyses at high resolution over the Labrador Sea and adjacent areas. Comparisons of analyses with and without NSCAT data showed that the use of NSCAT winds results in large improvements in analysis accuracy. Specifically, NSCAT is able to detect cyclones before other observing systems and to more accurately locate the positions of cyclones and fronts. SSM/I wind speeds are superior in coverage to NSCAT, but less useful in the analysis of cyclones and

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fronts. The SSM/I line of sight winds have not yet been shown to be useful; further work may be required to optimize their utilization.

IMPACT FOR SCIENCE APPLICATIONS

Scatterometer and passive microwave wind data can be utilized very effectively to improve weather analyses, forecasts and warnings over the oceans. The high resolution VAM can be used to assimilate these data objectively.

TRANSITIONS

Not applicable

RELATED PROJECTS

None in DOD

PUBLICATIONS

Atlas, R., 1997: Atmospheric observations and experiments to assess their usefulness in data assimilation. J. Meteor. Soc. of Japan, 75,1B, 111-130.

Atlas, R. 1997: Wind speed and velocity, In press. Remote Sensing Data Book, Cambridge University Press.

Chou, S., R.M.Atlas, C. Shie and J.Ardizzone, 1997: Air-sea fluxes retrieved from SSM/I data. J. Geophys. Res., 102, C6, 12,705-12726.

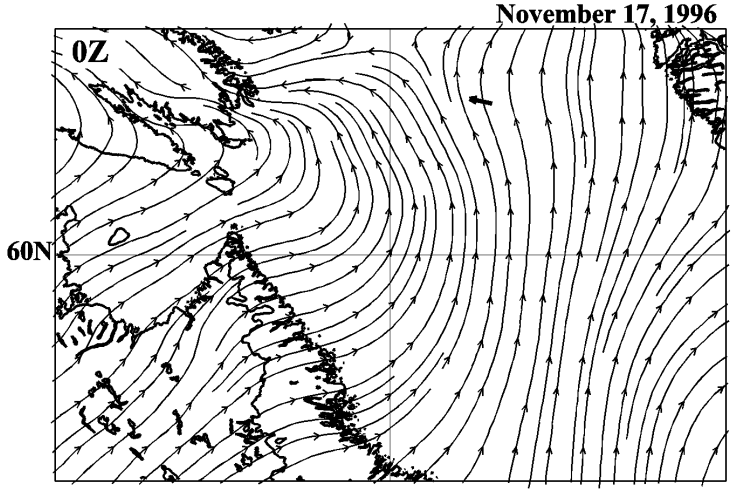
Jusem, J. C. and R. Atlas, 1997: Diagnostic evaluation of vertical motion forcing mechanisms by using Q-vector partitioning, Accepted. Mon. Wea. Rev.

Use of NSCAT Winds in the Labrador Sea

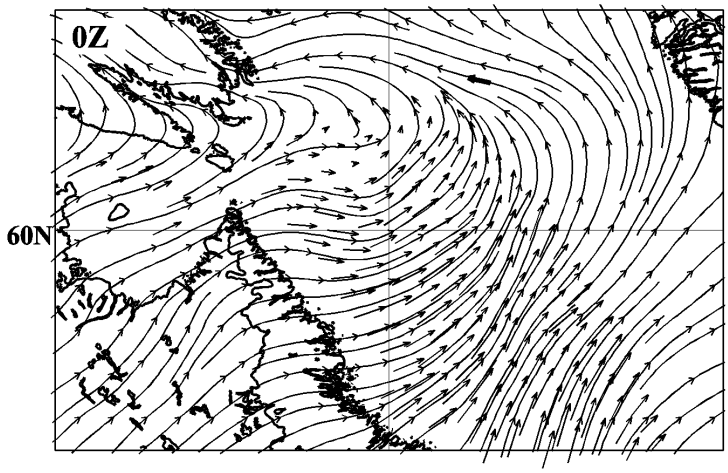
The NOAA ETA model 48km resolution analysis (upper figure) shows broad cyclonic flow on the western side of the Labrador Sea. The variational analysis of NSCAT data using the ETA analysis as a background field (middle figure) indicates a much more pronounced cyclonic flow. This is more consistent with the cyclone analyzed over the Lab Sea 6 hours later (bottom figure). Available ship observations (shown as bold vectors) are also in better agreement with the variational analysis .

November 17, 1996

ETA 48KM WIND ANALYSIS



Variational Analysis of NSCAT Winds Using ETA 48km Analysis as a Background Field



NOAA Wind Analysis 6 Hours Later